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ANNIVERSARY PUBLICATIONS.

THE VALUE OF A STUDY OF BOTANY.*

BY HENRY WADE ROGERS, PRESIDENT OF NORTHWESTERN UNIVERSITY.

When I accepted the invitation to speak at this banquet, the Chancellor of Washington University, through whom the invitation had been most courteously conveyed, took the trouble to have sent to me the Annual Reports of the Garden containing the addresses which have been delivered on occasions similar to this. I, of course, felt it my duty to read every one of those addresses, and when I concluded the last of them I was in doubt as to the real intentions of the Chancellor. For if he had desired to alarm me, to create a self-distrustful spirit within me, and make me shy, he could not have taken a more effective means to that end. I acquit the genial and distinguished gentleman of having cherished any such malicious design. I confess that after reading those addresses I had various and sundry misgivings as to whether after all I had any message to bring to you that was worthy of the occasion, and not a repetition of what had already been said. But notwithstanding I am exceedingly glad to be with you, and to add my tribute to those which others have paid to a man whom we all of us recognize as having been a great public benefactor. It seems to me that this splendid city of the great Mississippi Valley can never have numbered among its citizens a man more deserving than Henry Shaw to have his name spoken with admiration and honor. The people whose home is here have on other occasions been told how

* An address delivered at the Sixth Annual Banquet to the Trustees of the Missouri Botanical Garden and their guests, May 17, 1895.

much Henry Shaw was deserving of their respect, and that, to quote the language of another, for the reason Antony said Cæsar deserved the loves of the people of Rome—

“ He hath left you all his walks,
His private arbours, and new planted orchards,
On this side Tiber; he hath left them you,
And to your heirs forever; common pleasures,
To walk abroad, and recreate yourselves.”

I have not, however, left important duties and traveled several hundred miles simply to eulogize what this man did for the city in which he made his home. What he did was not local. It was not confined to this city, nor to this State, nor to the United States. He gave to the world the means whereby the boundaries of human knowledge might be enlarged, boundaries that extend beyond those of any city, State, or country. And so it happens that every year since he died men have been willing to come from Universities in the North, the South, the East, and the West in order that they might pay tribute to one who has rendered service to the race.

The name of Henry Shaw is enrolled in the Golden Book of the Republic. And for years to come, whenever in any portion of our country mention is made of the great philanthropists of the United States his name will be spoken with honor. Verily wheresoever in the whole world men discuss what has been done to enlarge the horizon of knowledge there also this that this man hath done deserves to be told for a memorial of him.

“ For myself,” said the great Spinoza, “ I am certain that the good of human life cannot lie in the possession of things which, for one man to possess, is for the rest to lose, but rather in things which all can possess, and where one man’s wealth promotes his neighbor’s.” The good of the life of Henry Shaw does not lie in the fact that he amassed millions which others lost, but that he so possessed them as to enable others to share with him in the benefits which

accrued therefrom, and that dying he devoted them to a purpose which would promote the knowledge, the well-being and the pleasure of those who were to come after him.

It is Ruskin, I believe, who declares that the first of all English games is making money. He announces that it is an all-absorbing game, that we knock each other down oftener in playing it than at football, that it is absolutely without purpose, and that no one who engages heartily in the game ever knows why. The game is not played to get money to do anything with. But the player gets it only that he *may* get. And if you ask him, "What will you make of what you have got?" he answers, "Well, I'll get more."

Now we all know that money-making is a game that is very much played in the United States. England has not a monopoly of it by any means, and while we have not played at the game as long as they have on the other side, we have been in some respects more successful at it, and have made our country the richest nation of the world. I note, however, this difference between the game as played in England and America. More of our players have seemed to know why they were in the game, and what they wanted the money for. More have played that they might get the money to do something with and fewer that they might simply get more. The result has been that our country has produced more splendid philanthropists than any other in the world, and our generation has in this respect excelled any of the generations that have preceded it. It will have to be confessed, I fear, that some of our munificent givers have not always been particular as to the manner in which they reached the goal, and that they have sometimes won by as foul "slugging" as ever disgraced a game of football. It is, however, to be said to the honor of Henry Shaw that he made his money in a legitimate manner and devoted it all to a noble purpose. And we are able here to-night to commend what he did as an example to the youth.

We may tell them to make money as he did that they may help, as he did, in the uplift of the race, and let us bid them not to make money simply that they and their descendants may belong to the luxuriously-living idle class whom Froude likens to the Olympian gods, condescending to show themselves in their Empyrean, and saying to their worshipers: "Make money, money enough, and you and your descendants shall become as we are, and shoot grouse and drink champagne all the days of your lives."

A few years ago and the study of botany was regarded merely as a sort of elegant accomplishment, to be studied appropriately by young women and dilettante young men.

Now it has become recognized as a serious occupation worthy of all the encouragement that the best of our universities can give to it. Its study commends itself alike to the class who demand that the end of education shall be the attainment of culture, and to that other class who are demanding that education shall be practical and who would apply the principle of utility to every branch of study pursued. Its study has intellectual value and stands for culture. It also has economic value and stands for utility. If it simply possessed economic value its place would be in the technical schools. But because it has an intellectual and culture value it is entitled to a place in the curriculum of the colleges of liberal arts. That it is assigned to such a place in all of our institutions for the higher learning is evidence of the fact that educators are agreed in believing that the study of this subject affords valuable intellectual training, and that it is an aid to culture.

In 1869 Mr. Huxley declared that he conceived it would be one of the greatest boons which could be conferred upon England if henceforward every child in that country should be instructed in the elements of botany, and of physics. And he stated that he named these two subjects in preference to any other of the natural sciences because he was convinced that every educational advantage which training

in physical science could give was obtainable from their proper study.

The old notion that there is but one road to culture, and that the avenue of Latin and Greek, we know to be no longer tenable. Mr. Arnold, who has been called the chief apostle of culture, tells us that the meaning of culture is to know the best that has been thought and said in the world, and that the essence of culture is a criticism of life. If we accept this as an explanation of what is meant by culture then I say with Huxley that "An army, without weapons of precision and with no particular base of operation, might more hopefully enter upon a campaign on the Rhine, than a man devoid of a knowledge of what physical science has done in the last century, upon a criticism of life."

I approach this subject free from the bias which one might have who had been trained in sciences. My own education was in the classics. But I am a firm and devout believer in the intellectual and culture value of the study of the sciences.

The intellectual value of the study of botany probably differs but little from that which attaches to the study of any of the natural sciences. The process which is employed is that of induction, and the student must exercise his faculties of observation and comparison. Having observed and compared, he draws general conclusions from the particular cases. The mental discipline which this involves is very different from that which results from a study of the languages, or history, or mathematics. I can only repeat what has been many times pointed out by others, that in the study of languages and history the facts are accepted on the evidence of authority and tradition, while in mathematics the student has given him a few simple and self-evident propositions from which he deduces certain necessary and definite conclusions. On the other hand, in the study of botany, zoology, and other of the natural sciences, nothing is taken for granted; the student observes for himself the

facts, and practices his intellect in the most complete form of induction. The exercise of the intellectual faculties which this involves tends, more than does the study of languages or history or mathematics, to develop originality of mind and exactitude of knowledge. The mind is trained to attention and accuracy, the two mental qualities in which all mankind are said to be more deficient than in any other whatever. To do good work in botany requires great exactitude, patience and judgment.

Thiselton Dyer in an address before the British Association for the Advancement of Science, made in 1888, speaking of the intellectual value of the study of botany, declared that he did not doubt that precisely the same qualifications of mind which made Jeremy Bentham a great jurist, enabled his nephew to attain the eminence he reached as a botanist. And he added that "as a mere matter of mental gymnastic, taxonomic science will hold its own with any science." John Stuart Mill, who himself possessed a competent knowledge of botany and was therefore a competent judge of the intellectual value of the study, tells us that the proper arrangement of a code of laws depends on the same scientific conditions as the classifications in natural history, and that there could not be a better preparatory discipline for that important function than the principles of a natural arrangement, not only in the abstract, but in the actual application to the class of phenomena for which they were first elaborated, and which are still the best school for learning their use. He also informs us that of this Jeremy Bentham was perfectly aware, and that his *Fragment on Government* contains clear and just views on the meaning of a natural arrangement which reflect directly the influence of Linnaeus and Jussieu.

The study of botany deserves to be encouraged because of the pleasure which a knowledge of the science brings within reach of those who are its votaries. The trees, the shrubs, the flowers are a new delight, and a constant pleasure to those who know and can interpret the story of

their existence. We study literature because we find in it a ministry of joy which gladdens, invigorates, and rests us. But the trees and the flowers constitute a ministry of joy, and to those who really know them they are companions ministering to the higher and purer delights of life, and voicing, like some old Gregorian chant, the praise of God. They praise him and magnify him forever — even as it has been written: “O all ye green things upon the earth, bless ye the Lord; praise him and magnify him forever.”

They speak to those who know them a language full of meaning. It was Wordsworth, I believe, who said: “To me the meanest flower that blows can give thoughts that often lie too deep for tears.”

Huxley has advocated the study of natural history because it leads us to seek the beauties of nature instead of trusting to chance to force them on our attention. “To a person,” he says, “uninstructed in natural history, his country or seaside stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall. Teach him something of natural history, and you place in his hands a catalogue of those which are worth turning round.”

The study of botany deserves encouragement too for what it has already accomplished and is capable of hereafter accomplishing for agriculture. Within the memory of men here present the theory of agriculture has been revolutionized by virtue of the better knowledge of the subject which the botanists together with the chemists have ascertained and diffused. I shall not undertake to set forth at length what has been accomplished in this respect. But I wish to say that the new fields of botanical research which are now being developed give promise of results of the greatest economic importance. I refer to the study of that class of plant diseases which are due to parasitic bacteria, and to which attention was first called about 1880, by a distinguished botanist of the State from which I come. These investigations have disclosed well

defined diseases of bacterial origin in tomatoes, potatoes, melons, oats, corn, sorghum, beans, beets, peas, and apples. If the science of botany shall reveal the nature of such diseases and provide a remedy whereby the life of the plant shall be preserved and a decrease in the yield prevented, it will surely render a service the value of which it would be difficult to estimate. And it is gratifying to know that the larger part of what has been accomplished along this line has been due to American botanists.

The botanist has already made it known that the "blights," "mildews," "rusts," "smuts," etc., found on the various kinds of vegetation are themselves true plants, and that they are limited in their development like other organic species by certain conditions and surroundings. Some of these limitations he has already made known, while others remain to be ascertained by him. While the botanist has not yet been able to suggest the means of effectually destroying in all cases the injurious fungi, yet he has been able to make most valuable suggestions whereby much of the loss formerly entailed has been very considerably reduced. In some cases he already knows how to exterminate the parasites and in others how to prevent their ravages. As to the economic value of what he has already accomplished, take the one subject of oat smut. In a publication issued under the authority of the United States Department of Agriculture in 1892, it was estimated that the net gain to the farmers of this country between 1880 and 1890 (from a system of treatment of oat seed now known which would have produced a crop free from oat "smut") would have been not less than \$162,000,000.

One object Mr. Shaw had in establishing a School of Botany in connection with the Botanical Gardens was, as stated in the will, to promote the application of the science of Botany to Arboriculture. The cultivation of trees on scientific principles promises to become a matter of great economic importance — even to us in the United States. At the present rate of consumption, according to the Chief

of the United States Department of Forestry, we have hardly one hundred years of forest supply in sight, and certain kinds of supplies are already beginning to give out. The end of even the white pine resources is said to be plainly in view in both this country and Canada. It is desirable to extend our knowledge of the principles of scientific forestry. Forests have an economic value as a source of fuel, as a source of timber, and for their influence on agriculture. We know that they effect climatic conditions, and that the amount of rainfall is influenced by the forest area. Too much rain is unfavorable to farm crops, and too extensive forests may prove disastrous to agriculture. Science teaches that where the rainfall is over forty inches the forest area should not be increased. This important science of forestry rests on a knowledge of botany, and the botanists are "the apostles of forestry."

Again, the study of botany deserves encouragement because of the intimate dependence upon it of the science of medicine. The art of preparing and compounding medicines with reference to their physical properties involves a knowledge of the different parts of plants, the method and season of their collection, and of their desiccation and preservation. It is not too much to say that the student of medicine who fails to possess a sound knowledge of the great truths respecting vegetable as well as animal life cannot be other than empiric.

One of the great educational needs of our country is that of a thoroughly equipped School of Botany. There is no place in the United States where such a school could be better developed than here in connection with the Washington University and these magnificent Gardens, unsurpassed by any Gardens in the world unless it be by the famous Kew Gardens of London. What is needed is an adequate teaching force with specialists in each of the various departments of botany. This would make your University easily the great center for botanical investigation and instruction, not only for the United States but

for the world. To-day the German Universities are far in advance of the English and American Universities in the advantages which they offer, but with a little effort your own University might easily be put in the lead.

Over in India on the banks of the Jumna stands what is pronounced to be the most wonderful structure ever erected by man. It is a thing of beauty and a joy forever. It stands in the center of a spacious park, and on a marble terrace thirty feet high. It is built of white marble. Its dome shines like a globe of silver and at the top is a golden crescent. It is approached through a gateway of red sandstone and the avenue from the gate to the tomb is said to contain eighty-four fountains, and a large marble reservoir bordered by rows of cypress trees. The songs of birds are said to mingle with the rippling of the fountains, and the air is described as freighted with the delicious fragrance of the rose and the orange. Wrought into this magnificent Taj are thousands of pounds of opals, other thousands of pounds of rubies. Woven in the splendid designs are still other thousands of pounds of emeralds and thousands of sapphires, of carnelian, and of turquoise. Thirty-five different kinds of carnelian are said to be used in a single leaf of a carnation, and one blossom not larger than a dollar contains twenty-three gems, while a single flower is made of three hundred different stones. The beauty of it surpasses description and the expensiveness of it is beyond apprehension. More millions have been lavished on it than on any university in Europe or America. All this treasure was lavished simply to build a tomb. It adds nothing to the sum of human knowledge, and save as it is a memorial of love and a monument of beauty it contributes nothing to the betterment of mankind. I cannot help thinking how much better it would have been to have slept in an unpretentious sepulcher and devoted these millions as Shaw did his to that which would have advanced the knowledge, the pleasure, the health, and the wealth of mankind.



CATTELYA LUTEOLA.